

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: COPPOLA, Giuseppe

SERIAL NO.: 10/624,189

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EXAMINER: Lyons, M.A.

TITLE: INTERFEROMETRIC SYSTEM FOR THE SIMULTANEOUS MEASUREMENT OF THE INDEX OF REFRACTION AND OF THE THICKNESS OF TRANSPARENT MATERIALS, AND RELATED PROCEDURE

AMENDMENT "A"

Director of the U.S. Patent
and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action of September 22, 2005, a response being due by December 22, 2005, please enter the present amendments and consider the following remarks:

REMARKS

Upon entry of the present amendments, previous Claims 1 - 12 have been canceled and new Claims 13 - 19 substituted therefor. Reconsideration of the rejections, in light of the forgoing amendments and present remarks, is respectfully requested. The present amendments have been entered for the purpose of placing the claim language into a more proper U.S. format and also for the purpose of placing the application into a proper condition for allowance. In the Office Action, it was indicated that Claims 1 - 6 and 12 were rejected under 35 U.S.C. § 103 as being unpatentable over the Isobe patent. The claims were also rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject

matter which Applicant regards as the invention. Importantly, it was indicated that Claims 7 - 11 were “objected to” as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form, including all of the limitations of the base claim and any intervening claims.

As an overview to the present reply, Applicant has extensively amended the original claim language in the form of new Claims 13 - 19. New Claims 13 - 19 express the original limitations in a more proper U.S. format, including proper antecedent bases and proper structural interrelationships throughout. Any indefinite terminology found in the original claim language has been corrected herein. In particular, new independent Claim 13 incorporates the limitations of original independent Claim 1, along with the limitations of dependent Claim 2 and the limitations of objected-to Claim 7. As such, independent Claim 13 should be in a proper condition for allowance. In those circumstances where functional recitations were included, Applicant is enclosing herewith claims in proper “mean-plus-function” terminology. Additionally, in independent Claim 13, the “sample of transparent material” is positively recited. The “computing means” is recited in “means-plus-function” format so as to properly include the limitations of previous dependent Claim 7 whereby the steps required for determining the “index of refraction” and the “thickness of the sample” are recited. Applicant believes that the terminology found in independent Claim 13 should place the application into a proper condition for allowance and should remove the formality objections suggested by the Examiner.

Dependent Claims 14 - 16 correspond, respectively, to the limitations found in original dependent Claims 4 and 6. Dependent Claims 17 and 18 correspond to the limitations of original dependent Claims 8 and 9.

New independent Claim 19 is an independent Claim that specifies the “method” of measuring

an index of refraction and a thickness of a transparent material. The various steps associated with this method have been properly recited in independent Claim 19 in a more proper U.S. format. The limitations found in original Claim 12 have been canceled herein in view of the Examiner's objections.

Relative to the Isobe patent, it is important to note that the Isobe patent is for a method of measuring a refractive index and a thickness of a "thin film formed on a substrate". The method of the present invention is not limited to this special field of thin film analysis. In the method of the Isobe patent, the refractive index is measured and the thickness is measured only in the "reflection" mode. In the present invention, the refractive index and thickness are measured in transmission. The Isobe patent describes a preliminary calibration required in order to determine two typical angles corresponding to two arbitrary reflection maxima or minima points in the reflected signal. Then, by means of the various equations, an estimation of the refractive index and the thickness is carried out. Then, a third angle, with a different source wavelength, is measured. By means of a equation and by using the third angle, the new wavelength, the values of the refractive index, and the thickness are achieved. The Isobe patent evaluates new values for the refractive index and the thickness for the thin film. Finally, the correct pair of values is chosen through reasoning on the dispersion of the material.

In contrast, in the present invention, there is a technique for obtaining the refractive index and the thickness in an automatic way by analyzing continuous signals. In the present invention, the oscilloscope digitizes the interferometric signal obtained by changing both the incident angle (to obtain the shearing effect) and the wavelength of the laser source (to take in to account the dispersion of the material). The entire interferometric signal relative to the angles are used to calculate the product $n \cdot d$ at a single and special 0° and, then, use all of the interferometric signals to separate the

contribution of n and d for each angle. As such, the present invention requires the use of a variable wavelength laser source and a rotating stage in order to carry out the method of the present invention.

In the present invention, it is not necessary to determine such two or three angles in order to measure the refractive index and thickness. The method of the present invention is much more accurate since the present invention does not limit the measurement to two or three points. The Isobe patent uses only two laser sources with two separate wavelengths. In contrast, in the present invention, a single laser source is utilized having a wavelength that is tunable so as to allow the interferometric signals to be digitized for a large number of wavelengths. This improves the accuracy of measurements. The use of the collimator guarantees high accuracy in the measurement since an uncollimated beam that is refracted or reflected by a parallel plate will suffer from spherical aberration.

Applicant notes that, in dependent Claim 4, it is required that the sample be of a homogeneous material having planar and parallel faces. The Isobe patent does not require such a structure because of the Isobe patent works with one thin layer formed on a substrate.

Based upon the foregoing analysis, Applicant contends that independent Claims 13 and 19 are now in proper condition for allowance. Additionally, those claims which are dependent upon these independent claims should also be in condition for allowance. Reconsideration of the

rejections and allowance of the claims at an early date is earnestly solicited. Since no new claims have been added above those originally paid for, no additional fee is required.

Respectfully submitted,


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